

# PATENT ABSTRACTS OF JAPAN

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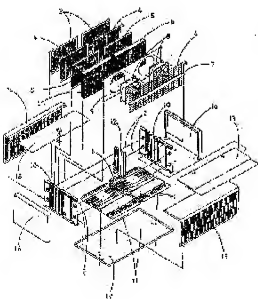
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**(54) AIR STERILIZING AND PURIFYING FACILITY WHICH INACTIVATES BACTERIA CAUGHT BY A COMBINATION OF ELECTRIC DUST COLLECTOR USING FILTER AS DUST COLLECTING ELECTRODE AND ELECTRONIC STERILIZER AND WHICH EXHIBITS ACTIVE BACTERICIDAL ACTION BY RELEASING SUPEROXIDE ANION RADICAL AND MINUS ION THROUGH ARRANGING ELECTRONIC STERILIZER ON THE BLOWOFF SIDE**



(57)Abstract:

**PROBLEM TO BE SOLVED:** To provide an air sterilizing and purifying facility in which sterilization and dust collecting function are conducted at the same time by a combination of plasma and corona discharge, in which superoxide anion radical and minus ion having bactericidal function are released in a room by a combination of new plasma and corona discharge on the blast side to inactivate floating virus and various bacteria, and in which dust is precipitated by an electric neutralizing action to improve environment in a room.

**SOLUTION:** In an electric dust collecting mechanism, electrons by corona discharge are utilized for a charge action, sterilization and dust collection are conducted at the same time in a series of flow by incorporating a plasma generating body generating the plasma region in the same mechanism, and further by placing an

electron irradiation portion by corona discharge, the plasma generating body on the blast side, a superoxide anion radical and a minus ion (electron) are contained in the air

purified by electric dust collection, and the air in a room is actively purified by bactericidal force and electric neutralizing force.

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## CLAIMS

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[Claim(s)]

[Claim 1]An air sterilization cleaning device which irradiated non-temperature-up type plasma generation bodies with a primary electron by corona discharge, generated a superoxide anion radical, and incorporated an electronic germicidal action by a superoxide anion radical.

[Claim 2]the time of giving positive charge to a dielectric electrode which eliminated a dust collecting function as much as possible, and a dielectric electrode -- electrostatic adsorption -- \*\* -- easy -- an air sterilization cleaning device which combines a filter which added a negative permanent electric charge, and has energization simultaneously a dielectric electrode, and a dust collecting filter electrode to which a filter is tinged with an electric charge of a like pole so that it can carry out.

[Claim 3]An air sterilization cleaning device which provided an auxiliary filter which carries out a duty of a pressure-loss filter for reducing a wind speed behind a dust collecting filter electrode, and raised adsorption efficiency of a dust collecting filter electrode to it.

[Claim 4]Arrange an electronic sterilizer which combined non-temperature-up type plasma generation bodies and corona discharge on blower fan back, and a superoxide anion radical and an anion are emitted to it, An air sterilization cleaning device which sterilizes indoor air actively and moreover carries out sedimentation removal of the suspended particle by electric carbonation of an anion (electron).

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Industrial Application]This invention is combining plasma and corona discharge, and two kinds, sterilization and a dust collecting function, are performed simultaneously, The superoxide anion radical and anion which moreover have a sterilizing function combining new plasma and corona discharge in the air blasting side are emitted indoors, It is related with the air sterilization cleaning device which makes dust the floating virus and saprophytic bacteria sediment by electric counteraction simultaneously with inactivation \*\*\*, and improves indoor environment.

[0002]

[Description of the Prior Art]In the indoor air cleaner, as seen in a filter or an electrostatic precipitation type, what carries out adsorption treatment of the dust by a certain method, the thing which irradiates with and sterilizes an ozone generating device and ultraviolet

rays in a device, or the method which fumigated gaseous ozone indoors and aimed at the bactericidal effect is used.

[0003]

[Problem(s) to be Solved by the Invention]Among these, in a filter system, in order to catch particles only by mere physical adsorption, it is hard to catch the particles of micron units, such as a virus and bacteria. If prehension particle diameter is made small, with pressure loss, a filter life will become short and will become inefficient.

[0004]In an electrostatic precipitation method, although it is said by the principle of electrostatic adsorption that prehension is possible to the particle diameter up to 0.001 micro, if it does not use combining a fan type, an effective removing effect cannot be expected. Although the removal range spreads by combining with a fan type, the suction force of an opposite side fan excels from electrostatic adsorption power, and, as for the range of prehension particle diameter, narrowing capturing capacity power declines.

[0005]use a filter type -- use an electrostatic precipitation type -- by both methods, it does not have the ability to inactivate the virus which carried out adsorption treatment, and bacteria, and there is also a device which has tried sterilization for ozone which is a by-product of what made a disinfection agent and titanium oxide support with a filter system, and aimed at the bactericidal effect, or corona discharge. However, when a bactericidal effect is not acquired, furthermore dust etc. are intermingled, any method becomes inefficient for a short time, in order that a sterilizing factor may not contact effectively.

[0006]In order to solve them, the device incorporating ozone or a ultraviolet water sterilizer is also seen, but all being different devices from a dust collecting function, and combining them means that the device itself becomes large. in order that ozone may demonstrate an effect via humidity also as a bactericidal effect, when receiving change of temperature and humidity, a question produces it in a bactericidal effect, and it seems that the method of irradiating with and sterilizing ultraviolet rays in contaminated air atmosphere of the relation top effect of transmission efficiency is also thin.

[0007]A thing [ any ] air cleaner has a common method which performs dust collection and sterilization within a device, circulates through a clean atmosphere, and purifies the interior of a room. The device itself will be enlarged, if the purification range and cleanliness are decided by the number of times of circulation and the thing asks for improvement in the wide range or cleanliness.

[0008]In addition, although there is also a device which fumigates ozone indoors and tries sterilization of a floating bacillus or an adhesion bacillus, ozone itself has an adverse effect on a strong oxidizer therefore human body, and incidental facilities, and it cannot call it an effective purification method.

[0009]On the other hand, this invention person was irradiating plasma with the electron of corona discharge, and while he generated the superoxide anion radical in active oxygen and inactivated a virus and bacteria efficiently, he succeeded in giving negative charge to dust by an electron and catching to a dust collecting filter electrode efficiently. Furthermore, the unit which combined plasma and a corona discharge device separately was provided in fan back, the superoxide anion radical and the anion were emitted indoors efficiently, and the method of carrying out sedimentation removal of the suspended particle by the electric neutralization power of sterilization of a floating

bacillus or an adhesion bacillus or an anion was established.

[Means for Solving the Problem]

[0010]A filter which formed a discharge ray of plasma generation bodies and a corona discharge part in the suction side, and made the back carry out permanent electrification of the negative charge in order to solve an aforementioned problem, An auxiliary filter which induces a pressure loss at a moderate interval is provided in a dielectric electrode and the next which can give actual positive charge, A functional filter (a catalyst or activated carbon) which furthermore adsorbs \*\* ozone and a difficulty decomposed component is used as a series of units, It is characterized by an air sterilization cleaning unit constituted so that plasma generation bodies and a corona discharge device might be separately combined with the downstream of a fan installed in the back, i.e., the air blasting side.

[0011]An invention concerning claim 1 prepares 2 sets of things which carried out heat coating of the special glass with equal thermal expansion force to tungsten for a tungsten wire of L shape which one of the two shortened, it is stuck so that a portion with longer L shape may be held, it joins both ends thoroughly with non-corrosiveness adhesives, and is made. In order to cause a plasma phenomenon, it is necessary to generate a dielectric breakdown by high tension but, and the more a coat of a dielectric, i.e., glass coating, is thick, high tension is needed and, the more it leads to dissociation energy being consumed by thermal energy simultaneously with a plasma generation.

[0012]Since an impression electrode and an earth electrode are manufactured [ according to the above-mentioned composition ] independently in manufacturing plasma generation bodies, when carrying out heat coating of a tungsten wire and the glass dielectric, it can manufacture as a very thin coat. The thing can bring about a dielectric breakdown, even if it does not apply high tension, and it can raise efficiency of dissociation energy which can acquire a discharge phenomenon at low temperature and is consumed with thermal energy.

[0013]An invention concerning claim 1 consists of shape which combined a large dielectric electrode (electrifying electrode) of two discharge rays and surface state so that a primary electron of corona discharge may irradiate plasma generation bodies of the above-mentioned composition effectively.

[0014]According to the above-mentioned composition, a superoxide ANIYON radical in which ozone and various kinds of active oxygen which are the by-products of dissociation and recombination which happen in a plasma region generated in the narrow range collide with an electron effectively, and have the quality of both sexes of the only oxidizing power and reducing power is generated. A process of generation becomes  $O_2 + e^- \rightarrow O + O + e^-$  by oxygen dissociation by plasma, and then serves as  $O + O_2 \rightarrow O_3 + O_2$  the first stage. It will become  $O_3 + e^- \rightarrow O + O + e^-$  if an electron of corona discharge furthermore collides. As for oxygen of the shape of this atom which dissociated, it dissociates directly and a part is [ what takes a form of singlet oxygen ( $^1O_2$ ) of a letter of excitation, and ] super oxy door NIONRAJI.

カル ( $O_2^*$ ) の二形態をとる事になる。先の一重項酸素は、さらに電子衝突を経

て  $^1O_2 + 2 e^- \rightarrow O_2^-$  となり、最終的にはスーパーオキシドアニオンラジカルに

It is changed.

[0015]By using the above-mentioned phenomenon effectively, decomposition of sterilization, deodorization, and a difficulty decomposed component is attained by

oxidation reaction by a superoxide anion radical. Since a superoxide anion radical holds an excessive electron, it will adhere easily with floating bacteria and an odor component which are the presentations of contaminated air to pass, and can expect a bactericidal effect and a deodorizing effect more.

[0016]An invention concerning claim 2 is constituted so that negative charge may be given to particles to pass and a function of electrostatic precipitation may be borne, at the same time it irradiates plasma with an electron by the corona discharge according to claim 1.

[0017]If a suction fan is provided in order to take a wide purification range although an electric charge of particles and a dust collecting electrode of reverse polarity are needed in order to use the above-mentioned phenomenon effectively, the suction force will excel rather than electrostatic adsorption power, it will imitate a fall of dust collecting capacity of prehension particles, and will be connected with \*\*\*. When cleaning caught particles, it must stop having to perform troublesome washing, if particles are directly caught to a dust collecting electrode.

[0018]By however, a thing to carry out to a mere dielectric electrode which equipped with an electrostatic filter made in a polypropylene fiber ahead [ dust collecting electrode ], and from which a dust collecting electrode was dropped to it for grid-like particle capturing capacity power as much as possible. An electrostatic filter made in a polypropylene fiber simultaneously with energization will be drawn by a principle of electrostatic adsorption to a dielectric electrode, and the same polar electric charge as a dielectric electrode will be held simultaneously.

[0019]In order to use the above-mentioned phenomenon effectively, a permanent electric charge of an electrostatic filter made in a polypropylene fiber is made into negative polarity. At the time of energization, the electrostatic filter made by a polypropylene fiber can touch a dielectric electrode which was able to give positive charge smoothly by doing so, An electrostatic filter made in a polypropylene fiber while touching will change polarity, will move to positive charge of reverse polarity, and bears a duty of a dust collecting filter electrode.

[0020]Particles which held negative charge by doing so will not adhere to a dielectric electrode with little adhesion area easily, and the most will stick to a dust collecting filter electrode which adhesion area was able to do in a polypropylene fiber given enough. If a dust collecting filter electrode furthermore made in a polypropylene fiber is made into an exchange type, it will become dirty, and if deposit efficiency falls, exchange becomes possible simply and washing work of a troublesome dust collecting electrode can be excluded. Since a dielectric electrode is formed by the shape of a grid, coating weight of particles does not lead to a fall of potential which interferes with electrostatic adsorption, even if it adheres few.

[0021]In order to improve adsorption performance of a dust collecting filter electrode made in the polypropylene fiber according to claim 2, an invention concerning claim 3, An auxiliary filter made to generate pressure loss separately back is provided, and it is constituted by \*\* which electrostatic adsorption power excels from a suction force for the purpose of reducing a wind speed on a passage of contaminated air.

[0022]In order to use the above-mentioned phenomenon effectively, an auxiliary filter which carried out lamination thermal melting arrival of the special fiber to polyethylene rate textiles for causing pressure loss with a sufficient degree, and structure of providing

some space among both filters were established.

[0023]Although very small particles drawn from electrostatic adsorption power to a suction force by doing so pass a dust collecting filter electrode made in a polypropylene fiber. Since a wind speed of a suction force falls by pressure loss made with an auxiliary filter in space between both filters, it becomes the structure by which can draw near to a rear face of a dust collecting filter electrode which electrostatic adsorption power excelled and was made in a polypropylene fiber, and adsorption treatment is carried out.

[0024]An invention concerning claim 4 is making clean air which passed the highly efficient dust catcher style according to claim 3 newly pass through a plasma region and corona discharge regions, Oxygen and moisture (humidity) of a clean air ingredient are changed into a superoxide anion radical and minus atmospheric ion, It flows back indoors by power of a blower fan, and inactivation of sterilization of a direct floating bacillus or an adhesion bacillus is achieved by oxidizing power of a superoxide anion radical, and sedimentation removal of the suspended particle is carried out by electroneutralization by reducing power of minus atmospheric ion, and it aims at purifying the interior of a room actively.

[0025]In order to use the above-mentioned phenomenon effectively, in a series of flows of a to [ from claim 1 / claim 3 ], A part of air which passes purified air before flowing back indoors with a fan is made to generate a plasma region in non-temperature-up type plasma generation bodies, By making a primary electron generated by corona discharge collide with ozone which makes a part of the oxygen dissociate, makes atom-like oxygen, and is further generated through recombination, and other active oxygens. You transform an active oxygen of ozone or others to a superoxide ANIYON radical, and make it flow back indoors with an excessive electron, and it is a \*\*\*\*\* thing about a floating bacillus and an adhesion bacillus by oxidizing power of an oxygen radical.

[0026]It is because a reason which limits an oxygen radical which makes it emit indoors and contributes to sterilization here to a superoxide ANIYON radical is the only oxygen radical in which a superoxide ANIYON radical holds character of both oxidation and reduction among reactive oxygen species.

[0027]Since particles and bacteria to which having the quality of both sexes of oxidation and reduction floats indoors repeat a collision mutually and it has positive charge, reducing power which is the negative charge of reverse polarity bears a duty of electrostatic adsorption as an excessive electron, and \*\*\*\*\* is efficiently made as for it to a suspended particle or a floating bacillus. Then, a superoxide ANIYON radical which contacted leads to starting oxidation reaction promptly, taking an electron from quality of contaminatee, and contributing to decomposition or sterilization.

[0028]Quantity generated since an oxygen radical of ozone generated in a plasma region or others has a too much narrow plasma region is little, and remains in quantity also with naturally few superoxide ANIYON radicals changed with a primary electron with which it irradiates by corona discharge. So, quantity of a superoxide ANIYON radical actually emitted indoors is unable to exceed quantity of a primary electron emitted by corona discharge. Since quantity of a primary electron excels and it returns to oxygen which was returned by an electron and stabilized even if an excessive superoxide ANIYON radical remains, it can use as a germicide safer than an oxidizer of ozone or others.

[0029]Since an electron adheres to oxygen and humidity (moisture) in the air to pass and it furthermore flows back indoors as minus atmospheric ion, In order to neutralize an

electric charge of a suspended particle or a floating bacillus electrically and to check Brownian motion, a suspended particle and a floating bacillus which disappeared an electric charge pull and sediment automatically to attraction, and lead to a cleaning effect active in addition to suction removal of an indoor pollutant.

[0030]However, in a corona discharge method seen by common ion generator, a dielectric electrode which absorbs an electron which a discharge ray or a discharge needle which supplies negative charge had positive charge, and was emitted from a discharge ray or a discharge needle is arranged behind a discharge ray or a discharge needle.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1]It is a schematic diagram of the dust collection part of the air sterilization cleaning device concerning the embodiment of claim 1 of this invention, claim 2, and claim 3.

[Drawing 2]It is a schematic diagram of the dust collection part of an air sterilization cleaning device, and a sterilizing section concerning the embodiment of claim 1 of this invention, claim 2, and claim 3.

[Drawing 3]It is a schematic diagram of the feed zone of the active sterilization cleaning device of the air sterilization cleaning device concerning the embodiment of claim 4 of this invention.

[Drawing 4]It is a schematic diagram of the electrode used for this invention.

[Drawing 5]It is an embodiment figure of the example of this invention.

[Description of Notations]

- 1 Dust collecting filter electrode
- 2 Dielectric electrode
- 3 Auxiliary filter
- 4 A functional filter
- 5 Non-temperature-up type plasma generation bodies
- 6 Discharge ray
- 7 Dust collection part unit
- a Few intervals
- b Suitable space
- 1 Non-temperature-up type plasma generation bodies
- 2 Discharge ray
- 3 Dielectric electrode
- 4 Dust collecting filter electrode
- 5 Auxiliary filter
- 6 A functional filter
- 7 Dust collection part unit
- a Plasma region
- b Primary electron

- c Back run
- 1 Discharge ray
- 2 Air current stirring board
- 3 Non-temperature-up type plasma generation bodies
- 4 Dielectric electrode
- 5 Suction blower fan
- 6 A functional filter
- 7 Dust collection part unit
- a \*\* -- a style (ion wind)
- b Primary electron
- c Plasma region
- d Airstream
- 1 An impression electrode or an earth electrode
- 2 The dielectric which welded special glass
- 3 The joined part by special adhesive
- 1 Non-temperature-up type plasma generation bodies
- 2 Discharge ray
- 3 Dust collecting filter electrode
- 4 Dielectric electrode
- 5 Auxiliary filter
- 6 A functional filter
- 7 Air current stirring board
- 8 Suction blower fan
- 9 Fan attachment hardware
- 10 Dust collection part unit side plates
- 11 Dust collection part unit bottom plate
- 12 Dust collection part unit divider plate
- 13 Dust collection part unit sliding type top plate
- 14 Air sterilization cleaning device air-intake covering
- 15 Air sterilization cleaning device air blowing port covering
- 16 Air sterilization cleaning device frame side cover
- 17 Air sterilization cleaning device rear-face covering
- 18 Air sterilization cleaning device upper cover

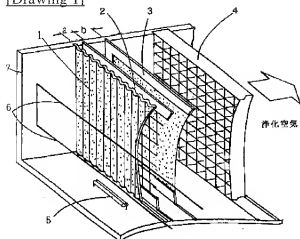
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## DRAWINGS

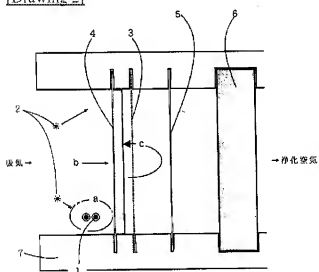
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[Drawing 1]



[Drawing 2]



[Drawing 3]



